

Carbon Nanotube Based Electric Propulsion Thruster with Low Power Consumption, Phase II

Completed Technology Project (2004 - 2006)



Project Introduction

Field emission electric propulsion (FEEP) thrusters have gained considerable attention for spacecrafts disturbance compensation because of excellent characteristics. The application of current FEEP has been slow in developing mainly caused by high specific power, which limit the milli-Newton thruster development due to insufficient onboard power. Dramatic field improvement from nanometer carbon nanotubes (CNTs) is a big advantage to increase the FEEP thrust more than 10 times under constant specific impulse (power). Phase I study showed a lower power consumption of 0.027 W/?YN from the CNT based ion source, comparing with the power consumption of 0.063 W/?YN from the traditional thruster. The CNT based FEEP ion source will be developed innovative in several aspects: integration of CNTs into the ion emission anode, buildup of the edge anode structure by the combination of the metal tip emitter and the slit emitter, and construction of a edge anode array capable of selective operation of different thrust unit. The power consumption of for ion thrust is expected to be reduced by a factor of 5 and more. The application of the room temperature carbon nanotube field emission electron neutralizer will further reduce the total power input to the ion engine.

Anticipated Benefits

Liquid metal ion source (LMIS) based focused ion beam (FIB) technique is used in different fields such as micro-fabrication and material analysis: secondary ion mass spectrometry (SIMS), accelerator mass spectrometry (AMS), high resolution self-assembled Monolayers (SAM) by the high energy FIB. As our knowledge, there is very limited companies are able to produce milliNewton thrusters. The success of this project will benefit not only the NASA space applications, also a large ion source markets.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

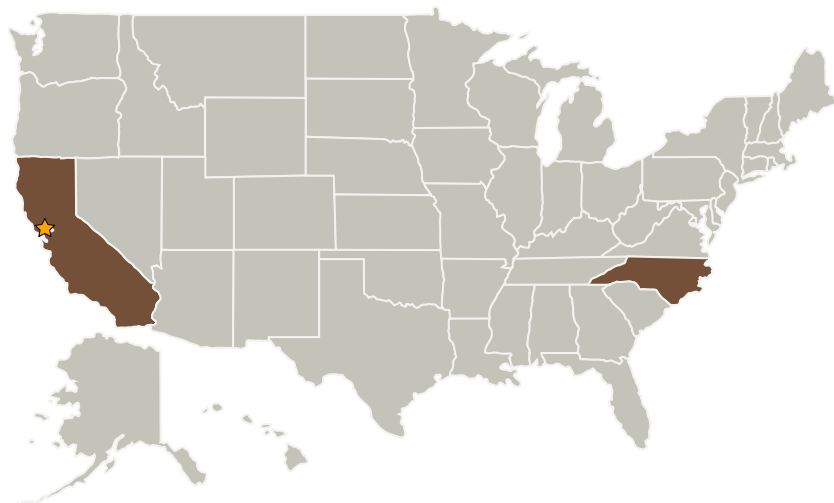
Small Business Innovation Research/Small Business Tech Transfer

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Xintek, Inc.	Supporting Organization	Industry	Chapel Hill, North Carolina

Primary U.S. Work Locations

California	North Carolina
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Harry Partridge

Principal Investigator:

Changkun Dong

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
 - TX11.1 Software Development, Engineering, and Integrity
 - TX11.1.6 Real-time Software